# The Division Aviation Brigade: Operational or Tactical?

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A current unclassified scenario from the Command and General Staff College is examined to determine the maximum distance that an aviation brigade must be able to move to be considered operational. An historical study is examined to determine the minimum amount of time in which that maximum distance must be traversed. And current references are examined to determine the amount of firepower required upon arrival in the battle area.

Through the use of current accepted values for probability of kill and helicopter versus tank exchange ratios, the available firepower of massed Army aviation forces are examined. One scenario shows the results of twelve attack helicopter battalions delaying a three division breakthrough in the army group area.

The monograph concludes that the division aviation brigade is not an operational

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## ABSTRACT

THE DIVISION AVIATION BRIGADE: OPERATIONAL OR TACTICAL INSTRUMENT? by LTC James L. Mowery, USA, 32 pages.

This monograph analyzes the capability of the division aviation brigade to be used as an operational instrument--at the army group level.

A current unclassified scenario from the Command and General Staff College is examined to determine the maximum distance that an aviation brigade must be able to move to be considered operational. An historical study is examined to determine the minimum amount of time in which that maximum distance must be traversed. And current references are examined to determine the amount of firepower required upon arrival in the battle area.

Through the use of current accepted values for probability of kill and helicopter versus tank exchange ratios, the available firepower of massed Army aviation forces are examined. One scenario shows the results of twelve attack helicopter battalions delaying a three division breakthrough in the army group area.

The monograph concludes that the division aviation brigade is not an operational instrument under current conditions, but could become an operational instrument with improvements in technology and command and control.

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## Introduction

In World War II the Army Air Corps formations that supported the Army Ground Forces did not begin as operational formations. Known as Air Support Commands, they were subordinate to an army or corps headquarters and had no mechanism or headquarters that would allow the massing of air force assets against the decisive point within the theater of operations. After the hard knocks of North Africa, those air corps formations were restructured into Tactical Air Forces with a senior air corps headquarters that could direct all air formations anywhere in the entire theater of operations.[1&2]

Today, the helicopter accomplishes many of the same functions as the close air support fixed wing aircraft of the World War II tactical air forces. Debates even occur about which is the best close air support aircraft, the A-10 or the AH-64. However, under the current system Army aviation formations are employed only by tactical commanders: division and corps.

Considering the experience of close air support formations in World War II, it is worthy of analysis to determine if the U.S. Army's aviation formations have an operational role in addition to their proven method of tactical employment. Moreover, if such analysis determines that an operational role for helicopter formations exists, then further study is required to determine if they are manned, equipped, and organized to perform

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[1] Tactical was the term used by the Army Air Forces in WWII to differentiate between strategic bombing formations and the formations that directly supported Army Ground Forces. The term operational as it relates to a level of war was not in the U.S. military lexicon during WWII (Author's Note).

[2] Major Stephen T. Rippe, "An Army and Air Force Issue: Principles and Procedures for Airland Warfare. A Perspective of Operational Effectiveness on the Modern Battlefield," MMAS Thesis (Fort Leavenworth, KS: 1985), pp. 9-18. This thesis synthesizes the works of Momyer, Tedder, and other works on this subject.

in an operational role. The base organization used to examine the questions above is the Division Aviation Brigade. This is the primary formation that contains the combat support and combat service support helicopters that are essential for operational sustainment. Additionally, many division aviation brigades have already been formed and have participated in numerous field exercises and other evaluations.[3] For these reasons the topic of operational versus tactical roles for the Army's aviation brigades will be confined to the division aviation brigade.

Furthermore it can be inferred that if the division aviation brigade is an operational instrument, then the corps aviation brigade is also an operational instrument. Therefore it is necessary only to make the case for the primary unit--the division aviation brigade--for, if the logic in this paper points to an operational role for the division aviation brigade, then that same logic can be applied to the corps aviation brigades.

This leads to the statement of the principal research question: Is the division aviation brigade an operational or tactical instrument?

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[3]To date there have not been any corps aviation brigades formed or tested with the exception of the Sixth Cavalry Brigade at Fort Hood, TX. Although the Sixth Cavalry Brigade is called a corps aviation brigade, it is at present little more than an attack helicopter regiment since the brigade consists of only three attack helicopter squadrons. The remainder of the forces that would bring it to full strength are in the reserves or on paper.

## The Value of Operational Utility

Aviation lends one very desirable quality: mobile firepower--mobile firepower that could allow the operational commander to focus combat power very quickly at the decisive point. If the mobile firepower of the division aviation brigade can be employed in the sectors of adjacent divisions just as easily as it is employed in its own division's sector, then it is offered that its assignment as an organic element of a division unnecessarily confines the combat power of the aviation brigade to the tactical level. Furthermore, if that mobility is such that the division aviation brigade can also be employed throughout the army group sector, then its present assignment to the division confines the use of its combat power even further.

If the combat power of the division aviation brigade is operationally mobile yet confined to operations in division sectors only, then a potential exists that even though that combat power will be used, it will be confined to the tactical battles of individual divisions, and thus not used in places which are decisive to the campaign. Worse yet, it could remain uncommitted. This same situation with the close air support formations in North Africa in World War II contributed to the Allied problems in that campaign. Those problems were the direct result of confining the air formations into specific ground unit sectors without providing a mechanism for massing at the decisive point.[4]

It is important that we fully exploit the potential of the aviation brigade. Aviation brigades that can move quickly from anywhere in the army group sector to the decisive point provide the corps and army group commanders

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[4] Rippe, op. cit. pp. 11-18.

with a potent force that can change the tempo and intensity of the battle more quickly than the opposing enemy commander can. Or, at least it can match the tempo of the opposing enemy commander if he is doing the same with his helicopter formations. Another argument is that if such mobility exists and we do not have plans to take advantage of it while the enemy does, then there is grave potential that the enemy would have the capability of operating within our decision cycle by massing combat power at the decisive point before we can counter it effectively.

## The Situation Today

The time gap between the formulation of an idea and its assimilation are important enough to review at this juncture. As Colonel (US Army, Retired) Trevor N. Dupuy, the noted author and historian, says in his book The Evolution of Weapons and Warfare,

> There have been three basic preconditions historically for assimilation of new weapons or ideas:
> 1. An imaginative, knowledgeable leadership focused on military affairs, supported by extensive knowledge of, and competence in, the nature and background of the existing military system.
> 2. Effective coordination of the nation's economic, technological-scientific, and military resources.
> 3. Opportunity for battlefield experimentation as a basis for evaluation and analysis.
>
> When these conditions have been present, there has usually been a time lag of approximately twenty years, or one generation, between the initial experimental adoption of a new weapon and its full assimilation. It is notable that this time lag does not seem to have changed much over the course of the past century, despite the fact that science and technology have been producing new weapons, or adaptations of weapons, in accelerating numbers and at an accelerated pace. When the conditions have not been present..., the process of assimilation has been even slower.[5]

The helicopter as an anti-tank fire support system dates from its first use in Viet Nam around 1970. Aviation as a branch dates just from 12 April 1983. Brigade formations of helicopters date from 1984 and are already fielded in each division. Developments in refueling, communications, and weapons delivery are offering even further utility for Army aviation. In other words, Colonel Dupuy's research that it takes twenty years or one generation fully to assimilate new ideas indicates that there is still some distance to travel with respect to Army aviation.

The suggestion here is that Army aviation formations of today have much

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[5] Trevor N. Dupuy, The Evolution of Weapons and Warfare (Fairfax, Virginia), pp.304-307.

more utility than is shown by current policies. The equal distribution concept of one per division can be compared to the French use of armor in 1940. The placing of much of the combat power from the corps aviation brigade in the reserves limits the capability of that formation to mass aviation even within the corps area of operations. The failure to provide adequate liaison structure, air defense forces, and to some degree the failure to recognize the need for the proper night vision equipment limit aviation even in the tactical area of the division. What is really interesting in all of this is that much of it reads the same as the Air Force after action reports from World War II.[6]

The purpose of this monograph is to offer a possibility for what may be the full use of attack helicopter formations.

## Another Air Force?

Do not construe this as an attempt to begin another Air Force. Helicopter aviation is a part of the ground forces--Army and Marines.[7] A separate service of helicopter forces or a sub-service component of the Air Force would only serve to exacerbate any problems that already exist and would do nothing for the effectiveness of US forces.

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[6] Condensed Analysis of the Ninth Air Force in the European Theater of Operations (Washington, D.C., 1946), pp. 93-104.

[7] Hans Ulrich Rudel, the foremost air anti-tank killer in history, when asked whether a close air support flyer should be a soldier or an airman first, replied, "A close air support flyer is a soldier first, a soldier second, and a soldier third. The air to air and bomber flyers should be airmen first and soldiers second." Battelle Institute Study. Rudel had 519 confirmed tank kills in WWII. A confirmed anti-tank kill was not recorded unless the tank exploded or burned. It is estimated that Rudel's actual kills may have exceeded 1500.

## Methodology

The methodology used to determine if the division aviation brigade is operational or tactical begins with the definitions of agility and operational maneuver. These are defined to set the stage for this examination.

Next, using current sources, the size of an operational maneuver area is derived. First, FM 100-5 is used to determine which level of command is normally associated with operational maneuver. Then a current scenario showing the boundaries of that level of command is examined to find the size of the area of operations for an operational unit.

With the dimensions of an operational area established, the time required to transit those distances is developed. Using a comparison that correlates moving modern units over long distances, a time to move ground units is established and then logic is applied to find the appropriate time for a division aviation brigade.

The capabilities of the aviation brigade with respect to firepower are examined next. Using the probability of kill for a Hellfire missile and the expected loss ratios for tanks and attack helicopters on the current battlefield, tables are developed showing the expected destruction that can be achieved by a single division aviation brigade and multiple division aviation brigades.

Then the ability of the brigade to move to the point of decision and apply its inherent firepower is explored. Three movement techniques are examined: CH-47 only, organic transport only, and C-130 only.

Finally conclusions are drawn from this examination and recommendations are offered to utilize fully the capabilities of division aviation brigades.

## Definitions

FM 100-5 defines agility as, "...--the ability of friendly forces to act faster than the enemy--is the first prerequisite for seizing [regaining] and holding the initiative."[8] This agility is a function of the unit's mobility, the unit's command and control system, the unit commander himself, the unit's ability to sustain its tempo, and the unit's survivability in its intended combat environment.

FM 100-5 states that,

> Operational maneuver seeks a decisive impact on the conduct of a campaign....Tactical maneuver seeks to set the terms of combat in a battle or engagement....At all levels, effective maneuver demands air and ground mobility,...effective command and control, flexible operational practices, sound organization, and reliable logistical support....Effective operational maneuver requires the anticipation of friendly and enemy actions well beyond the current battle, the careful coordination of tactical and logistical activities, and the movement of large formations to great depths.[9]

The above definitions have many key words in common: Mobility/maneuver, Sustainment/logistics, and Command and Control. Agility and maneuver are the reasons aviation is allocated such a large share of the budget. That investment was made to meet tactical needs, and has proven sound. This examination now looks at Army aviation's ability to meet operational needs.

For a unit to be effective operationally it must be able to have a decisive impact on the campaign itself. In the defensive scenario, one of today's major problems is the capability to attack with decisiveness an Operational Maneuver Group (OMG) that has penetrated into a corps' rear area. The capability to destroy at least an enemy division's worth of assets every

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[8] Field Manual 100-5, Operations (Washington, DC: October 1986), p. 16.

[9] Ibid., p. 12.

12 hours, and thus delay the OMG long enough for [illegible] destruction by ground forces, would be an example of operational effectiveness. In the offensive scenario, the capability to delay the enemy's reserve forces moving to attack a successful friendly penetration is another of today's major problems. If the division aviation brigade can buy the necessary time for the army group to move and commit the ground forces required to destroy the enemy in the area of his success before the arrival of enemy reserves, that would be another example of operational effectiveness. Of course to do all of that--to be operationally effective--a unit must be able to move throughout the army group sector in a timely manner and with enough firepower to make a difference. To do that it must have mobility, sustainability, firepower, survivability, and command and control.[10] Thus an examination of an operational environment and aviation's role as a contributor to operational success is necessary.

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[10] Ibid., pp.11-14.

## Operational Time and Distance

The division aviation brigade must have an operational radius of 300 kilometers to be considered an operational instrument.[11] The derivation of that distance follows. The definition is not in any single manual, and therefore must be extracted from more than one source.

The methodology for determining operational distance included a definition of which level of unit was operational and an unclassified scenario that showed the boundaries of that level. FM 100-5 "Operations" provided the definition for which level of organization is usually operational, and the October 1985 version of Training and Doctrine Command's (TRADOC) Common Teaching Scenario (TCTS) provided that level's boundaries in an unclassified scenario. FM 100-5 states that

> No particular echelon of command is solely or uniquely concerned with operational art, but theater commanders and their chief subordinates usually plan and direct campaigns. Army groups and armies normally design the major ground operations of a campaign. And corps and divisions normally execute those major ground operations....
>
> TACTICS
>
> While operational art sets the objectives and pattern of military activities, tactics is the art by which corps and smaller unit commanders translate potential combat power into victorious battles and engagements....[12]

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[11] The operational radius derived--300 kilometers--reflects the maximum distance that a division aviation brigade would have to move in order to affect the battle anywhere in the army group sector or zone. In most cases the division aviation brigade should be closer to the battle area. For example, an enemy attack into any U.S. division would find that division's aviation brigade within a maximum 50-75 kilometers of the battle. If other U.S. divisions were on the flanks of that division, then those divisions' aviation brigades would be within a maximum of 100-150 kilometers from the battle. The 300 kilometer distance allows a division aviation brigade from any division to be used anywhere in the army group area.

[12] Ibid., p. 10. Underlined portions are author-added emphasis.

Using FM 100-5, an operational/tactical boundary between the corps and the army group headquarters in the NATO environment was drawn. Then using the offensive and defensive scenario maps and orders in the TRADOC Common Teaching Scenario (TCTS), the operational distances associated with an army group were derived. Using this methodology the distance of 300 kilometers was the derived distance in both the defensive and offensive scenarios.[13] The fact that the same distance was derived in the separate calculations of the offensive and defensive scenarios lends further credibility to the 300 kilometer figure.

Distance has no meaning without relating it to time; therefore it is necessary to derive how quickly a division aviation brigade must be able to move that 300 kilometers to be considered an operational instrument. Time begins when the brigade receives the order to move and ends when the brigade crosses the line of departure for the attack. The derivation of this time-distance equation follows.

The time in which a unit must move a certain distance to be considered operational is also not defined in any manual. To derive that time, a work that examined operational moves in history and compared those moves to modern operations was examined. An excellent treatment of such is found in Major Peter S. Kindsvatter's monograph, "An Appreciation for Moving the Heavy Corps--The First Step in Learning the Art of Operational Maneuver." In his monograph he compares the movement of the III US Corps during the Battle of the Bulge in WWII to a hypothetical move of the XX US Corps in the same area in 1985. The longest distance moved in his examination was just over 200

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[13] See Annex E to this paper for the derivation of those distances.

kilometers. Although all units close in less than 48 hours, it is 48 hours before they cross the line of departure. The 48 hour period reflects the time required to receive the order, disseminate it, conduct other planning such as reconnaissance in the new area of operations, update or amend previously issued orders, and cross the line of departure.[14] The division aviation brigades will provide a readily available operational force to the army group commander if they can be maneuvered to the decisive point quickly enough to shape the battle for the coup de grace by ground organizations also moving to the battle.[15]

The aviation force will need time to find the enemy and then attack him. Additionally, once the enemy forces are attacked, time is required to develop the situation--to establish a picture of the situation so that the friendly ground forces can be provided with the proper information needed to develop their attacks. The aviation force must arrive quickly enough to accomplish those tasks before the friendly ground forces arrive. If some of the friendly ground forces could arrive as early as 48 hours later, then it seems logical that 24 hours would be an appropriate time for army aviation. Therefore, the assumption is made that for an aviation unit to have operational utility, it must be able to move 300 kilometers in 24 hours or less.

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[14]Major Peter S. Kindsvater, "An Appreciation for Moving the Heavy Corps--The First Step in Learning the Art of Operational Maneuver," School of Advanced Military Studies Monograph (Fort Leavenworth, KS: 16 May 1986), pp. 1-20.

[15]Author's Note: It is important to reiterate the fact that the role of Army aviation in this scenario is to delay the enemy force long enough to maneuver friendly ground formations to positions where they can contain or destroy the enemy formations.

## Operational Firepower

Moving 300 kilometers and beginning an attack or defense in 24 hours or less doesn't mean much unless a unit has effective firepower. Again no references are available for determining the level of firepower required for a unit to be considered operationally effective. Here again assumptions must be made. The assumption is that any time an enemy front or combined arms/tank army commander is confronted with a force that can disable or destroy 60% of a division's armored assets every 12 hours, it is going to have an effect on the operational plans of that commander.[16]

The division aviation brigade, depending upon the availability of artillery in the area of operations, provides the army group commander with

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[16]Interview with LTC(P) Patrick M. Hughes at Fort Leavenworth, Kansas, AV 552-3497, Civilian 913-684-3497. LTC(P) Hughes is an Army War College Fellow who has extensive knowledge concerning Soviet operations. LTC(P) Hughes stated that no classical norm that represents when a Soviet commander will revert from the attack to defense exists. The Soviet commander will make that decision based on correlation of forces and his mission. However, a Soviet front commander who had one of his combined arms armies or his OMG sustaining losses equivalent to 60% of a division's worth of assets every 12 hours, would surely reconsider his original plans. This reconsideration of plans would almost be a certainty if our ground forces maneuvering for the final destruction of the Soviet force were detected by the Soviet commander. Confronted with such a situation, the Soviet commander would have three options available: continue the attack, defend, or withdraw. Author's Notes: Attack helicopters do their best against moving formations and their worst against stationary, defending formations. If the Soviet commander continues the attack, he continues to subject his force to the destructive firepower of the attack helicopters and to the maneuver of our main killing power--our ground forces. If he defends, he decreases his exposure to the attack helicopters, but exposes himself to the maneuver of our ground forces. And, if he withdraws, although he is subject to attack by attack helicopters, he avoids exposure to our ground forces.

the following firepower capability per mission flown.[17]&[18]

| Table 1 | Rockets not Required | | | Rockets Required | | |
|---|---|---|---|---|---|---|
| | Hellfire Missiles | 2.75in Rockets | 30mm Cannon | Hellfire Missiles | 2.75in Rockets | 30mm Cannon |
| Each AH-64 | 16 | 0 | 1,200 | 8 | 38 | 1,200 |
| 30 AH-64's | 480 | 0 | 36,000 | 240 | 1,140 | 36,000 |

Hellfire missiles are the critical quantity in Table 1 because they are the principal tank destroying weapons. The current family of 2.75 inch rockets is used to suppress other than armored systems and to "button up" tanks and BMP's. The 30 mm is used for self defense and destroying "soft-skinned" targets.[19]

The amount of Hellfires carried has no meaning unless it can be converted to a number that represents damage to enemy forces. The equations used by the modelers to determine that are long and complicated. For this reason one simple range of numbers and one simple number will be used here to ease the presentation of that process. First, the range 30 to 75 is used as the percentage for the probability that an enemy vehicle would be killed if a

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[17] If no artillery is in zone, the attack helicopters will have to use rockets to meet their suppressive fire requirements. When this is required, the number of hellfire missiles that can be carried on a single mission is reduced by one half. This occurs because hellfire launch rails must be replaced by rocket pods in order to carry rockets.

[18] The division aviation brigade's combat forces are two attack helicopter battalions and one cavalry squadron. In the attack helicopter battalions, 30 of 36 AH-64's should always be fully mission capable--85% availability. The cavalry squadron will be able to participate with its helicopters only. Its ground forces are not helicopter deployable and cannot otherwise reach the objective area in a timely manner. The cavalry squadron's 8 AH-64's are not considered in these equations because they will be used for security and reconnaissance, not for attacking the enemy formations. Author's Note #1: One of the major roles of the cavalry squadron will be in its security and reconnaissance actions with respect to enemy helicopter formations.

[19] The 30mm can be used to destroy BMP's, but at a range that greatly decreases the survivability of the AH-64.

Hellfire is launched.[20] (The 75 percent figure equates to an unsophisticated enemy/air defense environment, while the 30 percent figure equates to a modern first line Soviet force.) Second, a thirteen to one kill ratio for enemy tanks to friendly attack helicopters is used.[21]&[22]

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[20]This number was obtained during a telephone conversation with Mr. Howard Haeker of the Training and Doctrine Command's Analysis Command at Fort Leavenworth, Kansas (TRAC-FLVN). AV 552-4510 or Civilian 913-684-4510. Mr. Haeker serves as the Chief of Programs and Quality Assurance, the Deputy Director of TRAC-FLVN, and the Executive Officer of TRAC-FLVN. The range 75 to 30 represents the $P_r$ (probability of a reliable missle) times $P_h$ (probability of hit) times $P_k$ (probability of kill if a hit occurs). It is $P_h$ that causes the range to move between 75 and 30. $P_h$ decreases as the threat increases--missles that are launched are subsequently lost because of aircrew reaction to enemy activity. Example: An AH-64, using the direct mode of fire, launches a missile. When the missle is half way to the target the pilot sees a ZSU-X begin to fire at him. The pilot masks the AH-64 behind intervening terrain and moves to another firing position--the missile is lost, but the AH-64 is not hit.

[21]The 13 to 1 exchange ratio remains constant regardless of whether missile $P_k$ remains at 75% or decreases to 30%. Although $P_k$ changes, it changes as a result of AH-64 crew input--not as a result of enemy hits on the helicopter. Because of aircrew observation of threat actions directed at their helicopter, the crew makes inputs that result in helicopter survival but also result in the missile breaking lock on the target. Whether the aircrew's observation and resultant inputs are caused by direct (observing weapons being fired) or indirect observations (indications on radar detection devices, laser detectors, radar jammers, etc.) is not a factor.

[22]The 13 to 1 exchange figure was obtained during an interview with Mr. Rudy Pabon, Acting Chief, Data Management Branch, Model Support Division, Scientific and Technical Support Directorate, TRAC-FLVN. AV 552-5601 or Civilian 913-684-5601. Mr. Pabon has extensive knowledge in war game data. This exchange ratio is argued about more than any other figure in this paper. The armor expert feels that 5 to 1 is a high figure and the aviation expert feels that 30 to 1 is acceptable. The figure 13 to 1 was settled upon as it is the figure supported by war game data.

Table 2: Field Artillery not in Zone--Rockets Required [23]
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills
75 Per Cent Probability of Kill

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 30 | 1 | 240 | 75% | 180 | 14 | 16 |
| 16 | 2 | 128 | 75% | 96 | 7 | 9 |
| 9 | 3 | 72 | 75% | 54 | 4 | 5 |
| Total | | | | | | |
| 55 | | 440 | 75% | 330 | 25 | 5 |

Table 3: Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills
30 Per Cent Probability of Kill

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 30 | 1 | 240 | 30% | 72 | 6 | 24 |
| 24 | 2 | 192 | 30% | 58 | 4 | 20 |
| 20 | 3 | 160 | 30% | 48 | 4 | 16 |
| Total | | | | | | |
| 74 | | 592 | 30% | 178 | 14 | 16 |

[23] Sixty-five per cent of the AH-64 losses are repairable. Of that 65%, 30% of those can be returned to service in 6 hours; 25% in 24 hours; and, 45% in 72 hours. For the data cited in the table that means 16 AH-64's of the 25 AH-64 losses can be returned to service in 72 hours: 5 in 6 hours; 4 more in 24 hours; and the final 7 in 72 hours. This data was obtained from unclassified references used in the Europe 6 scenario. Data provided by Major Steven Accinelli, AV 552-4858; Civilian 913-684-4858. Major Accinelli is currently the Project Team Leader for Vector-IN-Commander, a corps level simulation game. Author's Note: Related to this equation is the fact that repairability is a function of recoverability. In offensive scenarios recoverability may not be possible for many of the helicopters.

In the preceding cases a division aviation brigade offers the ability to destroy between 8% and 21% of a motorized rifle division's worth of combat power with one attack--about two to three hours of combat.[24&25] Although the above calculations do not take into effect the thousands of things that could go wrong, they also use only one aviation brigade.

With four division aviation brigades (2 attack battalions each: total of 8) and two corps aviation brigades (currently 3 attack battalions each: total of 6) available to an army group commander, the potential of aviation cannot be ignored.

If three division brigades were to attack just once, even without their cavalry squadrons, without artillery support (only 8 Hellfires per helicopter), and with only a 30% probability of kill, there is still potential for the destruction of 216 armored vehicles or 24% of the armored vehicles in a Soviet motorized rifle division and 33% of the armored vehicles in a Soviet tank division. If one corps brigade of 3 attack battalions is added, then the potential for the destruction in one attack increases to 324 armored vehicles or 37% of the armored vehicles in a Soviet motorized rifle division and 49% of the armored vehicles in a Soviet tank division. This information is displayed in table 5B on the page after next.

Although some will dispute the destructive capabilities of aviation, it

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[24]One attack is the figure used because 50% losses in the attack helicopter force would probably equal or exceed acceptable losses.

[25]The number of armored vehicles in a Soviet Motorized Rifle Division is 682. The number of armored vehicles in a Soviet Tank Division is 656. Armored vehicle totals include Tanks, BRDM's, BMP's, SP artillery, and SP air defense systems only--towed or wheeled artillery and air defense vehicles have not been included. Source is FM 100-2-3, The Soviet Army, dated July 84.

must be remembered that in the defensive scenario, aviation is attacking a moving enemy force that is operating with only the most mobile of its air defense forces.[26] If this enemy is forced to stop in order to come to grips with the aviation elements, then the aviation forces have indeed affected the battle.

Tables for 75% Probability of Kill

Table 4A: Six (6) Attack Helicopter Battalions
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kill

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 90 | 1 | 720 | 75% | 540 | 42 | 48 |
| 48 | 2 | 384 | 75% | 288 | 22 | 26 |
| 26 | 3 | 208 | 75% | 156 | 12 | 14 |
| Total | | | | | | |
| 164 | | 1372 | 75% | 984 | 76 | 14 |

49 of the 76 AH-64's lost are repairable in 72 hours.

Table 4B: Nine (9) Attack Helicopter Battalions
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 135 | 1 | 1080 | 75% | 810 | 62 | 73 |
| 73 | 2 | 584 | 75% | 438 | 34 | 39 |
| 39 | 3 | 312 | 75% | 234 | 18 | 21 |
| Total | | | | | | |
| 247 | | 1976 | 75% | 1482 | 114 | 21 |

74 of the 114 AH-64's lost are repairable in 72 hours.

[26] The Egyptian experience in their 1973 war with Israel is good example of what happens to units that outrun their air defense.

## Tables for 30% Probability of Kill

Table 5A: Six (6) Attack Helicopter Battalions
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 90 | 1 | 720 | 30% | 216 | [illegible] | 73 |
| 73 | 2 | 584 | 30% | 175 | 13 | 60 |
| 60 | 3 | 480 | 30% | 144 | 11 | 49 |
| Total | | | | | | |
| 223 | | 1784 | 30% | 535 | 41 | 49 |

32 of the 49 AH-64's lost are repairable in 72 hours.

Table 5B: Nine (9) Attack Helicopter Battalions
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 135 | 1 | 1080 | 30% | 324 | 25 | 110 |
| 110 | 2 | 880 | 30% | 264 | 20 | 90 |
| 90 | 3 | 720 | 30% | 216 | 17 | 73 |
| Total | | | | | | |
| 335 | | 2680 | 30% | 804 | 62 | 73 |

47 of the 73 AH-64's lost are repairable in 72 hours.

Thus from the tables above it is apparent that the potential of massed aviation is significant. Even at the 30% $P_K$ level--a level found when fighting first line, well trained, Soviet units--six battalions of AH-64's can destroy 535 armored vehicles after three successive attacks (about 8 to 12 hours of combat)--61% of a Soviet motorized rifle division or 82% of a Soviet

tank division.[27] If the 75% $P_K$ level is used--non Soviet or non first line Soviet formations--then, as shown in Table 4A on page 18, those same six AH-64 battalions can be expected to do the same amount of damage in just one attack.

The analysis above has shown Army aviation formations fighting full strength, first line Soviet forces of unspecified size. In reality those Soviet forces would be operating at reduced strength due to ordinary maintenance alone, while other losses for various reasons could also be reasonably expected. With respect to size, a breakthrough that required the army group commander to organize such a counterattack would probably be at least two or more divisions, while a breakthrough that required a corps commander to organize such a counterattack would probably be at least one division.

The following scenario depicts an army group counterattack by twelve AH-64 battalions against a Soviet combined arms army of three 80% strength divisions--one tank and two motorized or about 1900 armored vehicles--that has broken through in the army group sector. The aviation force commander has decided to attack with all twelve battalions for the first two attacks

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[27] Author's Note #1: Soviet helicopters have not been ignored in this discussion. The cavalry squadron(s) should have enough firepower to guard the attack helicopter battalion attacks. If the cavalry squadron(s) does not have enough combat power to guard the attacks, then some attack helicopter assets may have to engage the enemy helicopters. It is imperative that the reader remember that U.S. attack helicopter formations are anti-tank forces. Attack helicopters can defeat enemy helicopters, but such action diverts U.S. helicopters from their primary mission of destroying enemy armor.

Author's Note #2: The use of combined arms has not been forgotten in this paper. The Soviets will have a coherent ground combined arms team complete with their own helicopter force and frontal aviation assets during the battles discussed herein. Initially the U.S. force will be composed of army aviation assets, whatever ground forces are in zone, and all available air force assets. However, for simplicity's sake, this paper's examination treats just army aviation's contribution to this combined arms battle.

and then to attack continuously with six battalions--six fighting and six resting until the battle is resolved.[28] The aviation force commander expects the first set of battles to last about 6 hours and the next two sets to last about 8 to 12 hours each.

Table 6A: Twelve (12) Attack Helicopter Battalions
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 180 | 1 | 1440 | 30% | 432 | 33 | 147 |
| 147 | 2 | 1176 | 30% | 353 | 27 | 120 |
| Total | | | | | | |
| 327 | | 2616 | 30% | 785 | 60 | 132* |

*12 of the 60 AH-64's lost are repairable in 6 hours.

Table 6B: Six (6) of Twelve (12) Attack Helicopter Battalions
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 66 | 1 | 528 | 30% | 158 | 12 | 54 |
| 54 | 2 | 432 | 30% | 130 | 10 | 44 |
| 44 | 3 | 352 | 30% | 106 | 8 | 36 |
| Total | | | | | | |
| 164 | | 1312 | 30% | 394 | 30 | 42* |

*6 of the 30 AH-64's lost are repairable in 6 hours.

[28] Crew endurance is a critical factor. Aircrews cannot fight indefinitely. If the movement phase--the 24 hours used to get to the battle area--did not allow for sufficient rest for the crews, then crew endurance is even more critical.

Table 6C: Six (6) of Twelve (12) Attack Helicopter Battalions
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 66 | 1 | 528 | 30% | 158 | 12 | 54 |
| 54 | 2 | 432 | 30% | 130 | 10 | 44 |
| 44 | 3 | 352 | 30% | 106 | 8 | 36 |
| Total | | | | | | |
| 164 | | 1312 | 30% | 394 | 30 | 42* |

*6 of the 30 AH-64's lost are repairable in 6 hours.

Table 6D: Twelve (12) Attack Helicopter Battalions--24 Hour Attack
Field Artillery not in Zone--Rockets Required
AH-64 Loss Rate = 1 AH-64 to 13 Armor Kills

| Number of AH's Attacking | Attack Sequence Number | Hellfire Missiles | Prob of Kill | Enemy Armor Kills | AH-64 Losses at 13:1 | AH-64's Remaining After Atk |
|---|---|---|---|---|---|---|
| 180 | 1 | 1440 | 30% | 432 | 33 | 147 |
| 147 | 2 | 1176 | 30% | 353 | 27 | 132* |
| 66 | 3 | 528 | 30% | 158 | 12 | 120* |
| 54 | 4 | 432 | 30% | 134 | 10 | 110* |
| 44 | 5 | 352 | 30% | 110 | 8 | 108* |
| 66 | 6 | 528 | 30% | 158 | 12 | 96* |
| 54 | 7 | 432 | 30% | 130 | 10 | 86* |
| 44 | 8 | 352 | 30% | 106 | 8 | 78* |
| Total | | | | | | |
| 655 | | 5240 | 30% | 1573 | 120 | 103* |

#37 of the 122 AH-64's lost are repairable under the 6 hr criteria.
@30 of the 122 AH-64's lost are repairable under the 24 hr criteria.
*Reflects repairable helicopters returning to service.

At the end of 24 to 32 hours of battle 1500+ of the 1900 vehicles in the enemy force have been destroyed. However, to accomplish this 12 of the army group's 14 attack helicopter battalions were required. On the other hand, if a higher $P_K$ were used then fewer battalions would be required

to achieve the same results. For example, a $P_K$ of 75% instead of the 30% shown above, destroys same 1500+ vehicles in just two attacks.[29 & 30]

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[29] Author's Note: A combined arms fight was not presented since the potential of the Army aviation force is not seen as easily when such an approach is taken. Both sides, of course, would view this fight as a combined arms and joint battle, with electronic warfare, air forces, and all other available forces being committed. Additionally, the effect of stripping the divisions of their aviation brigades was not specifically treated. The assumption is that the breakthrough had the priority.

[30] Increasing $P_K$ is critical as can easily be seen in the tables above. Any new technology that can increase $P_K$ through product improvements would quickly pay for itself in Hellfire "losses". Current technology such as mast mounted sights for attack and observation helicopters should reduce the enemy's probability of detecting our helicopters. This reduction in dectecton by the enemy should reduce the number of aborted engagements and the subsequent missile losses.

## Operational Mobility

So far we have assumed that a unit that can cover 300 kilometers on the battlefield in 24 hours or less possesses definitive operational mobility. We have also seen that the division aviation brigade possesses the potential combat power required to affect the battle. The next question to be answered then is: Can the division aviation brigade move 300 kilometers in 24 hours and fight? The division aviation brigade's helicopters normally self deploy by air for all movements except strategic moves. However the division aviation brigade's support equipment moves just like any other Army formation--in one of three ways: air, ground and air, or ground.

Can the division aviation brigade move 300 kilometers in 24 hours or less and be in condition to fight upon arrival? To answer that question requires some elementary calculations. That analysis follows. The basic facts required are the amount of ammunition, fuel, and support equipment that must be moved to allow the brigade's combat potential to be used. The brigade has 44 AH-64's, 50 OH-58's, 21 UH-60's, and 6 UH-1H's of which 36 AH-64's, 40 OH-58's, 17 UH-60's, and 4 UH-1H should always be operationally ready. However, because the command aviation company is required to support the division command group, only the observation section (6 OH-58's assigned and at least 4 operationally ready) and 1 UH-1H to support the aviation brigade commander will deploy with the brigade for a final total of 36 AH-64's, 36 OH-58's, 17 UH-60's, and 1 UH-1H. A minimum of 23 to 27 vehicles must be moved: 5 to support forward arming & refueling point's (FARP's), 10 to support command and liaison functions, and 8 to 12 to support

maintenance operations.[31] Approximately 32 tons of maintenance related equipment--test, measurement & diagnostic equipment (TMDE), parts, tools, etc.--will be required to support the brigade for three days of operations.[32] Additionally, enough fuel and ammunition to move to the battle area and fight must be transported. Tables laying out that information are found in Annexes A through D.

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[31]These figures are not available in any source I could find. They are derived from personal experience as a division aviation brigade operations officer and commander.

[32]These figures were not available in any source that I could find. The figure of 32 tons was developed by the author and Major Brinkley Wehner, an army aviation maintenance specialist, who has commanded aviation maintenance organizations in aviation companies, battalions, and brigades, and an aviation intermediate maintenance company in the division support command.

## Operational or Tactical?

The calculations in Annex A show that a division aviation brigade needs transport for 15.2 tons of aviation fuel for every 100 kilometers it moves, and 59.6 tons of aviation fuel and 63.1 tons of ammunition for every mission it is expected to fly.[33] Additionally, the vehicles (23 to 27: 5 to support FARP's, 10 to support command and liaison functions, and 8 to 12 to support maintenance operations), forward area refueling equipment (FARE's), and the 32 tons of maintenance related equipment (TMDE, parts, tools, etc.) required to support the brigade for three days of operations require transportation of an additional 115 tons. This adds up to 597 tons for a 300 kilometer move and one day of flying 3 missions. An additional 736.2 tons of aviation fuel and ammunition will be required for the next 48 hours of operations. However, for all calculations only the requirements to support the 300 kilometer move to the objective area and the ammunition to support the first 24 hours of operations were considered in the initial transportation requirements. The support requirements for the following 48 hours of operations would be delivered by the same assets that delivered the brigade in the first 24 hours or would be delivered by the brigade's own fuel and ammunition vehicles.

In the movement calculations below, the final movement time is calculated as follows:

1). Two to six hours to begin movement. This assumes that a plan has been developed and disseminated for <u>all</u> participants. The final destination may or may not have been determined. If it has, then the two hour period

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[33]Fuel requirements for generators and vehicles were not calculated. The unit Standard Operating Procedures for airmobile operations should specify that the fuel for these items are moved in 5-gallon cans with the equipment that needs it. This method has always proved adequate in my personal experience.

could be expected. If not, then the six hour period would be most likely.

2). Calculated movement times are increased by 50% increase for the "fog of war"--the unexpected.

3). No increase in time has been added for operations in the objective area because those operations would be planned concurrently with the movement to the objective area. Leaders would fly to the objective area with UH-60's moving essentials necessary to support these planning operations until the remainder of the brigade closed.

The calculations in Annex B show that the brigade with its required vehicles, maintenance, FARE's, and three missions' worth of fuel and ammunition can move 300 kilometers in 10.6 hours by using 24 CH-47's, the number that can be expected to be operational in two CH-47 companies. Although this would severely press the CH-47 crews, it could be done. Additionally, by doubling the number of CH-47's, the brigade can move the 300 kilometers in 5.3 hours.[34] Considering the "fog of war", a 50% increase in the calculated time seems reasonable as an outside estimate. Thus the brigade could be expected to close within 16 hours using just 24 CH-47's. This would not cause undue difficulties since 250 tons of the required 779 tons can start arriving after the first 10 hours of movement, and the brigade would still be able to execute at least one complete engagement. If six hours of pre-movement time are required, the brigade can be expected to close in 22 hours.

The calculations in Annex C show that the brigade with its required vehicles, maintenance, FARE's, and three missions' worth of fuel and

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[34]Only 3 CH-47 companies are currently available in all of Europe.

ammunition can move 300 kilometers in 12.9 hours by daylight road march and 18.8 hours by night roadmarch. Since neither figure represents a realistic time interval for day or for night, it is expected that the march will be 50% day and 50% night. A roadmarch of this nature would require 15.9 hours. Considering all the things that could go wrong, that time should be increased by 50% for a reasonable estimate of 23.8 hours. Adding either the best expected pre-movement time of 2 hours of planning time or the worst expected pre-movement time of 6 hours means that the brigade would close in 26 to 30 hours.

The calculations in Annex D show the brigade with its required vehicles, maintenance, FARE's, and three missions' worth of fuel and ammunition can move 300 kilometers in 13.1 hours using just 5 C-130 aircraft. Using 10 C-130's would require half that time. There is the additional complication of moving the brigade to the departure airfield and rigging the equipment for movement. If the departure airfield were 100 kilometers away, a brigade trained in this type of move could be expected to close and rig within 10 hours.[35] Thus using 10 C-130 aircraft the division aviation brigade could arrive in the objective area in 6.5 hours if there were no unexpected problems and in 10 hours assuming a 50% markup for the unexpected. If the brigade were 100 kilometers from the departure airfield and required only 2 hours for pre-movement planning, it could be expected to close in a little less than 22 hours. If the 6 hours of pre-movement time were needed, then the brigade could be expected to close in 26 hours. In other words, a trained brigade with a

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[35]Although 10 hours is the figure for a trained brigade, if the brigade had no previous training, it would be a leadership challenge of immense proportions to execute the movement to the airfield, the rigging of the equipment, and the loading in anything less than 20 hours.

prepared plan containing the arrival airfield could be expected to close on the objective area in less than 24 hours.

In summary, the calculations in Annexes A through D show that one aviation brigade, consisting of the operational assets needed to fight for 72 hours, can deploy 300 kilometers in less than 24 hours by using either CH-47's only, C-130's only, or a combination of the above; and using only the brigade's organic ground transport, it can close in under 30 hours. However, all of this is contingent on the availability of the required number of CH-47's and C-130's.

Although the above shows only one brigade moving to the objective area, more than one would most likely be needed. Additionally, not all of the brigades would be 300 kilometers from the objective area. If the attack were in a U.S. sector, then one brigade would be there from the beginning. At worst one brigade would be within 100 kilometers, while the others could be anywhere from 100 to 300 kilometers away. Assuming an attack 100 kilometers from the closest brigade, four brigades could be within the objective area in less than 24 hours. Using anything 200 kilometers or less from the objective area, a brigade moving even by its own assets and requiring 6 hours of pre-movement planning can close in less than 24 hours.

If one brigade moved by CH-47's and 24 were available (which is not unlikely), and one brigade moved using 10 C-130's from a departure airfield within 100 kilometers of its base (which is also not unlikely), while two other brigades moved 200 kilometers or less by their own assets, four brigades given 6 hours of pre-movement planning could be expected to be in the

objective area in under 24 hours.[36]

However, the problem just begins. Who will be in overall command? Who has the command and control assets to command? Who will control the movements into and out of the objective area? Who will manage the resupply of fuel, ammunition, and other needed supplies? At present there is no organization that has practiced such an operation even in Command Post Exercises (CPX's).

[36]The number of CH-47's and C-130's cited are readily available in Europe today.

## Conclusions

Although a division aviation brigade can move 300 kilometers in under 24 hours, and it has the capability to inflict damage on a Soviet division, it is not an operational formation today. The reasons that it is not operational follow:

1). It cannot deploy 300 kilometers in less than 24 hours using only its organic assets.

2). It must depend upon corps or army group assets to deploy 300 kilometers in 24 hours or less.

3). More than one division aviation brigade is required to expect 60 per cent damage to a Soviet tank or motorized division within 12 hours.

However, the aviation brigade can be a part of an operational formation by making some modifications. It has the capability, using a combination of CH-47's and C-130's, to move the requisite 300 kilometers in 24 hours. However, situations requiring quick moves by combat forces across the army group sector will not likely be resolved by only one brigade. It is reasonable to expect that three to four brigades will be required to stave off the onslaught until adequate ground combat forces can arrive to finish the job. At present, the command and control organizations for commanding and supporting such an operation are not in existence. Although the corps aviation brigade headquarters was initially designed to handle such a command and control requirement, spaces have precluded fielding it as originally designed. The movement and the handling of such a large force will require field exercises, command post exercises, simulations, and the like if any expectations of success on the battlefield are to be entertained. In other

words if the army wants to make operational use of its highly mobile aviation formations such as the division aviation brigade, then a reexamination of the army aviation structure is required. Thus, in its present design the division aviation brigade is a tactical instrument which possesses the capability of becoming an operational instrument.[37]

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[37]Final Note: 1). Tilt rotor aircraft, instead of helicopters, with their higher enroute speeds might reduce the amount of fuel needed for the 300 kilometer deployments discussed in this paper. Such a capability could reduce the number of CH-47D's required for a 300 kilometer move by as much as 33%. These CH-47's could then be used to expedite the move or be used to move lightweight artillery and artillery ammuntion to support the battle. 2). Higher $P_k$'s would reduce the number of Hellfires needed and further reduce the weight that had to be moved. Additionally, higher $P_k$'s would reduce the number of battalions needed to stop or delay enemy forces.

Annex A: Annunition, Fuel, and Other Support Tonnages Required for the Division Aviation Brigade[38]

| Type Helicopter | Avg Fuel Consumption Lbs per Hour | Fuel Capacity in Lbs. | Fuel Available (less 20 min res) | Normal Cruise in Km per Hr | Cargo Capacity in Pounds |
|---|---|---|---|---|---|
| AH-64 | 925 | 2405 | 2100 | 230 | NA |
| OH-58 | 175 | 465 | 407 | 175 | NA |
| UH-60A | 925 | 2360 | 2055 | 230 | 7000 |
| UH-1H | 600 | 1358 | 1160 | 175 | Used for C&C |
| CH-47D | 2600 | 6695 | 5837 | 230 | 20000 |

| Type Helicopter | # of Helos Assigned to Brigade | % of Helos Mission Capable | # of Helos Available to Deploy**** | # of Helos Not Mission Capable | Tot Wt in Tons of Maint, Fares & Vehicles* |
|---|---|---|---|---|---|
| AH-64 | 44 | 83% | 37 | 7 | |
| OH-58 | 50 | 80% | 36 | 10 | Vehicles--81 |
| UH-60A | 21 | 83% | 17 | 4 | Maint----32 |
| UH-1H | 6 | 75% | 1 | 2 | Fares----02 |
| CH-47D | 0 | 75% | 0 | 0 | Total---115 tons |

| Anno Data | Per AH-64 Config 1 | Per AH-64 Config 2 | # of Rounds per Pallet | Wt per Pallet in Lbs. |
|---|---|---|---|---|
| Hellfire | 16 | 8 | 12 | 2172 |
| 2.75 in FFAR | 0 | 38 | 60 | 2596 |
| 30mm | 1200 | 1200 | 2900 | 3736 |

| Anno Data | Config 1 Anno Consumption/24 hrs. per/helicopter | Config 1 Anno Consumption/Mission per/helicopter | Config 1 Wt of Anno Consumed/Msn per/helicopter | Config 2 Anno Consumption/24 hrs. per/helicopter | Config 2 Anno Consumption/Mission per/helicopter | Config 2 Wt of Anno Consumed/Msn per/helicopter |
|---|---|---|---|---|---|---|
| Hellfire | 48 | 16 | 2896 | 24 | 8 | 1448 |
| 2.75 in FFAR | 0 | 0 | 0 | 70 | 23 | 995 |
| 30mm | 1200 | 400 | 515 | 1200 | 400 | 515 |
| Total | | | 3411 | | | 2958 |

Notes: * This weight is the same for all scenarios regardless of distance.
** The highest annunition weight will be used.
*** Throughout all tables, the weights of blivets and packing material have been added if appropriate.
**** The Command Aviation Company is the Division's helicopter transport for the command group, therefore only the 1 UH-1H for the aviation brigade commander is deployed. This fact is reflected in all totals.

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[38] Data for this chart was taken from FM 1-104 Forward Arming and Refueling Points and FM 1-100 Army Aviation.

Annex A: Ammunition, Fuel, and Other Support Tonnages Required for the Division Aviation Brigade[39]

| Type Helicopter | Adjusted Cruise in Km per Hr | # of Helos Available to Deploy**** | Tot Fuel in Tons by Bde/100km | Tot Fuel in Tons by Bde/Msn | Config 1 Tot Ammo in Tons by Bde/Msn | Config 2 Tot Ammo in Tons by Bde/Msn |
|---|---|---|---|---|---|---|
| AH-64 | 175 | 37 | 9.8 | 35.9 | 63.1 | 54.7 |
| OH-58 | 175 | 36 | 1.8 | 6.6 | | |
| UH-60A | 230 | 17 | 3.4 | 16.5 | | |
| UH-1H | 175 | 1 | .2 | .6 | | |
| CH-47D | 200 | 0 | 0.0 | 0.0 | ** | |
| Total | | | 15.2 | 59.6 | 63.1 | 54.7 |

The brigade consumes 15.2 tons of fuel per 100 Kilometers;
59.6 tons of fuel per mission (2.1 hours per mission);
63.1 tons of ammo per mission (2.1 hours per mission);[40]
requires 32.0 tons of tools, test sets, equipment, and parts;
2.0 tons of forward area refueling equipment (FARE); and[41]
81.0 tons of vehicles (vehicles for command & control, maintenance support and liaison).[42]

Notes: * This weight is the same for all scenarios regardless of distance.
** The highest ammunition weight will be used.
*** Throughout all tables, the weights of blivets and packing material have been added if appropriate.
**** The Command Aviation Company is the Division's helicopter transport for the command group, therefore only the 1 UH-1H for the aviation brigade commander is deployed. This fact is reflected in all totals.

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[39] Data for this chart was taken from FM 1-104 Forward Arming and Refueling Points and FM 1-100 Army Aviation.
[40] Wehner, op. cit.
[41] Data on the FARE system is contained in FM 1-104 Forward Arming and Refueling Points, page 8.
[42] Data on the tonnage of vehicles was derived from the number of vehicles used and the appropriate maintenance manuals. The number and types of vehicles was derived from personal experience in a division aviation brigade.

Annex B. CH-47 Data: Number of CH-47's Required and Movement Times.[43]

If CH-47's from Corps are provided to move the brigade they will consume fuel as follows: Cruise Speed is 200 km, mission endurance is 2.1 hours. Fuel used per CH-47D per 100km = .65 tons. The cruise speed of 200 km is adjusted to allow for cargo pickup and dropoff. Notes: *** Throughout all tables, the weights of blivets and packing material have been added if appropriate.

| Distance Moved in Kms | Missions Flown in Obj Area | *** Support in Tons Req'd | CH-47D's Req'd | Time for 1 CH-47 to fly 1 Rd. Trip | Total Tons of CH-47 Fuel | Additional CH-47's Req'd for CH-47 Fuel | Time: 1 CH-47 Roundtrip to Refuel Sight |
|---|---|---|---|---|---|---|---|
| 100 | 1 | 259 | 26 | 1.0 | 31 | 0 | NA |
| 100 | 2 | 386 | 39 | 1.0 | 47 | 0 | NA |
| 100 | 3 | 514 | 51 | 1.0 | 62 | 0 | NA |
| 200 | 1 | 275 | 28 | 2.0 | 68 | 0 | NA |
| 200 | 2 | 403 | 40 | 2.0 | 97 | 0 | NA |
| 200 | 3 | 530 | 53 | 2.0 | 128 | 0 | NA |
| 250 | 1 | 284 | 28 | 2.5 | 85 | 0 | NA |
| 250 | 2 | 411 | 41 | 2.5 | 124 | 0 | NA |
| 250 | 3 | 538 | 54 | 2.5 | 163 | 0 | NA |
| 275 | 1 | 288 | 29 | 3.2 | 96 | 9 | 2 |
| 275 | 2 | 415 | 42 | 3.2 | 140 | 14 | 2 |
| 275 | 3 | 543 | 54 | 3.2 | 180 | 18 | 2 |
| 300 | 1 | 292 | 29 | 3.4 | 105 | 10 | 2 |
| 300 | 2 | 419 | 42 | 3.4 | 152 | 15 | 2 |
| 300 | 3 | 547 | 55 | 3.4 | 200 | 20 | 2 |
| 350 | 1 | 300 | 30 | 3.9 | 127 | 13 | 2 |
| 350 | 2 | 427 | 43 | 3.9 | 182 | 18 | 2 |
| 350 | 3 | 555 | 56 | 3.9 | 237 | 24 | 2 |

| Distance Moved in Kms | Missions Flown in Obj Area | Time for 1 CH-47 to fly 1 Rd. Trip | Time: 1 CH-47 Roundtrip to Refuel Sight | CH-47D's Req'd | Additional CH-47's Req'd for CH-47 Fuel | Time Req'd for 24 CH-47's to Move 1 Bde | Time Req'd for 48 CH-47's to Move 1 Bde |
|---|---|---|---|---|---|---|---|
| 100 | 1 | 1.0 | NA | 26 | 0 | 1.1 | .5 |
| 100 | 2 | 1.0 | NA | 39 | 0 | 1.6 | .8 |
| 100 | 3 | 1.0 | NA | 51 | 0 | 2.1 | 1.1 |
| 200 | 1 | 2.0 | NA | 28 | 0 | 2.3 | 1.2 |
| 200 | 2 | 2.0 | NA | 40 | 0 | 3.3 | 1.7 |
| 200 | 3 | 2.0 | NA | 53 | 0 | 4.4 | 2.2 |
| 250 | 1 | 2.5 | NA | 28 | 0 | 2.9 | 1.5 |
| 250 | 2 | 2.5 | NA | 41 | 0 | 4.3 | 2.1 |
| 250 | 3 | 2.5 | NA | 54 | 0 | 5.6 | 2.8 |
| 275 | 1 | 3.2 | 2 | 29 | 9 | 5.1 | 2.5 |
| 275 | 2 | 3.2 | 2 | 42 | 14 | 7.5 | 3.7 |
| 275 | 3 | 3.2 | 2 | 54 | 18 | 9.6 | 4.8 |
| 300 | 1 | 3.4 | 2 | 29 | 10 | 5.5 | 2.8 |
| 300 | 2 | 3.4 | 2 | 42 | 15 | 8.1 | 4.0 |
| 300 | 3 | 3.4 | 2 | 55 | 20 | 10.6 | 5.3 |
| 350 | 1 | 3.9 | 2 | 30 | 13 | 7.0 | 3.5 |
| 350 | 2 | 3.9 | 2 | 43 | 18 | 9.9 | 5.0 |
| 350 | 3 | 3.9 | 2 | 56 | 24 | 13.0 | 6.5 |

[43] Data for tables below were calculated using factors given in FM 1-104 Forward Arming and Refueling Points and FM 1-100 Army Aviation.

Annex C: HEMTT Data: Number of HEMTT's Required and Movement Times.[44]

HEMTT: Heavy Expanded Mobility Tactical Transporter

| Distance Moved in Kms | Missions Flown in Obj Area | Support in Tons Req'd less Vehicles | Fuel Tonnage Req'd | Fuel HEMTT's Req'd 4000 gal per | Ammo Tonnage Req'd | Ammo HEMTT'S Req'd @ 12 tons per | Total HEMTT's for Fuel, Ammo Maint |
|---|---|---|---|---|---|---|---|
| 100 | 1 | 177 | 74 | 6 | 63 | 5 | 14 |
| 100 | 2 | 305 | 134 | 10 | 126 | 10 | 23 |
| 100 | 3 | 432 | 194 | 15 | 189 | 16 | 34 |
| 200 | 1 | 194 | 90 | 7 | 63 | 5 | 15 |
| 200 | 2 | 321 | 149 | 11 | 126 | 10 | 24 |
| 200 | 3 | 449 | 209 | 16 | 189 | 16 | 35 |
| 250 | 1 | 202 | 97 | 7 | 63 | 5 | 15 |
| 250 | 2 | 329 | 157 | 12 | 126 | 10 | 25 |
| 250 | 3 | 457 | 216 | 17 | 189 | 16 | 36 |
| 275 | 1 | 206 | 101 | 8 | 63 | 5 | 16 |
| 275 | 2 | 334 | 161 | 12 | 126 | 10 | 25 |
| 275 | 3 | 461 | 220 | 17 | 189 | 16 | 36 |
| 300 | 1 | 210 | 105 | 8 | 63 | 5 | 16 |
| 300 | 2 | 338 | 164 | 13 | 126 | 10 | 26 |
| 300 | 3 | 465 | 224 | 17 | 189 | 16 | 36 |
| 350 | 1 | 218 | 112 | 9 | 63 | 5 | 17 |
| 350 | 2 | 346 | 172 | 13 | 126 | 10 | 26 |
| 350 | 3 | 473 | 232 | 18 | 189 | 16 | 37 |

Time for a HEMTT Convoy to move ( X ) Kms

| | Day Move | Night Move |
|---|---|---|
| 100 | 6.3 | 6.25 |
| 150 | 6.4 | 9.4 |
| 200 | 9.6 | 12.5 |
| 250 | 10.7 | 15.6 |
| 275 | 11.8 | 17.2 |
| 300 | 12.9 | 18.8 |
| 350 | 15 | 21.9 |

Notes: *** Throughout all tables, the weights of rivets and packing material have been added or subtracted as appropriate.

[44] Data in the tables were calculated using factors given in FM 1-104 Forward Arming and Refueling Points and FM 1-100 Army Aviation.

Annex D: C-130 Data: Number of C-130's Required and Movement Times.[45]

Allowable Load = 35,000 lbs which is 17.5 tons.

Cruise Speed--Adjusted for Time Required from Start Engines to Engine Stop at Destination--450 kms
Time to Load = 1 Hour and Time to Unload = 1 Hour

| Distance Moved in Kms | Missions Flown in Obj Area | * & *** Support in Tons Req'd | C-130's Req'd | Roundtrips for 5 C-130's to Move 1 Bde | Time Req'd for 5 C-130's to Move 1 Bde | Time Req'd for 10 C-130's to Move 1 Bde |
|---|---|---|---|---|---|---|
| 100 | 1 | 259 | 15 | 3.0 | 6.2 | 3.1 |
| 100 | 2 | 386 | 22 | 4.4 | 9.0 | 4.5 |
| 100 | 3 | 514 | 29 | 5.8 | 11.8 | 5.9 |
| 200 | 1 | 275 | 16 | 3.2 | 6.8 | 3.4 |
| 200 | 2 | 403 | 23 | 4.6 | 9.6 | 4.8 |
| 200 | 3 | 530 | 30 | 6.0 | 12.4 | 6.2 |
| 250 | 1 | 284 | 16 | 3.2 | 7.0 | 3.5 |
| 250 | 2 | 411 | 23 | 4.6 | 9.8 | 4.9 |
| 250 | 3 | 538 | 31 | 6.2 | 13.0 | 6.5 |
| 275 | 1 | 288 | 16 | 3.2 | 7.0 | 3.5 |
| 275 | 2 | 415 | 24 | 4.8 | 10.2 | 5.1 |
| 275 | 3 | 543 | 31 | 6.2 | 13.0 | 6.5 |
| 300 | 1 | 292 | 17 | 3.4 | 7.5 | 3.8 |
| 300 | 2 | 419 | 24 | 4.8 | 10.3 | 5.2 |
| 300 | 3 | 547 | 31 | 6.2 | 13.1 | 6.5 |
| 350 | 1 | 300 | 17 | 3.4 | 7.6 | 3.8 |
| 350 | 2 | 427 | 24 | 4.8 | 10.4 | 5.2 |
| 350 | 3 | 555 | 32 | 6.4 | 13.6 | 6.8 |

Notes: * Tonnage includes vehicles, maintenance equipment and FARE's shown in Annex A.
*** Throughout all tables, the weights of blivets and packing material have been added or subtracted as appropriate.

[45] Data in the tables were calculated using factors given in CGSC Student Text 101-2 Planning Factors, pp. 3-38 - 3-39.

Annex E--Derivation of the distance a unit must move in X time to be considered operational.

All distances are from the respective unit's rear boundary to the RIPL. The defensive scenario shows the Central Army Group (CENTAG) with an area of operations approximately 300 km wide and 400 km in depth. For its three subordinate corps--5th German, 10th U.S., and 12th U.S.--it shows widths of approximately 50-100 km and an average depth of 300 km.[46]

| Defensive Scenario | Width in Kms | Depth in Kms |
|---|---|---|
| CENTAG Dimensions | 200-425 | 380 |
| 5th GE Corps | 40-100 | 305 |
| 10th U.S. Corps | 40-100 | 280 |
| 12th U.S. Corps | 100-125 | 320 |

The offensive scenario distances were a bit more difficult to derive. The scenario for the offense departs from the defensive zone above and turns into the flank of the enemy advance. Distances shown are from the rear boundaries of the respective attacking units to that unit's final objectives. All other distances are from the respective unit's rear boundary to the RIPL. Two sets of distances are shown. The total distance figures represent the zone of attack for the two attacking corps and the defensive zone of the defending corps. The attack zone figures represent the zone of the main attack only. For the zone of the main effort CENTAG has an area of operations approximately 180 km wide and 480 km in depth. For its two attacking subordinate corps it shows widths of approximately 75-100 km and an average depth of 450 km.

| Offensive Scenario | Width in Kms | Depth in Kms |
|---|---|---|
| CENTAG Dimensions | 430 | 480 |
| 5th GE Corps | 100 | 190-240 |
| 10th U.S. Corps | 75-100 | 480 |
| 12th U.S. Corps | 250 | 430 |
| | | |
| Offensive Scenario Attack Zone | | |
| CENTAG Dimensions | 180 | 480 |
| 5th GE Corps-Attacking | 100 | 190-240 |
| 10th U.S. Corps-Attacking | 75-100 | 480 |
| 12th U.S. Corps-Defending | 250 | 430 |

The above figures were used to derive a set of distances a unit would have to negotiate to be considered operational.[47] For a unit to be operational it must be able to move to and fight anywhere in the army group zone. For the defensive scenario the division aviation brigade would normally be emplaced 50 to 100 km behind the FLOT. If a division aviation brigade were placed in either the left most or right most flank of the army group it would need to have an operational range of 300 km to be able to strike anywhere in the army group zone. For the offensive scenario the division aviation brigade would normally be emplaced 25 to 50 km behind the FLOT. If a division aviation brigade were placed in neither the left most or right most flank of the army group it would need to have an operational range of 300 km to be able to strike anywhere in the army group zone. For this reason the distance of 300 kms is offered as the distance an aviation unit must be able to negotiate in order to be considered operational. operational.

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[46] TRADOC Common Teaching Scenario. (Fort Leavenworth, KS, 1985), Map 2/2A.
[47] TRADOC Common Teaching Scenario. (Fort Leavenworth, KS, 1985), Map 3/2A.

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